

Driving Innovation and Growth

A Global Perspective



Science & Technology Cabinet
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Today's Presentation

- The Innovation Imperative
 - The rest of the world is not standing still
- U.S. Strengths and Challenges in Innovation
 - Recent U.S. Policy Initiatives
 - Myths and Realities in Innovation Policy
- Enhancing Innovation through Partnerships
 - The Role of the SBIR Program
 - Science and Technology Parks
- Fostering Innovation-led Growth in Loundon
- Conclusions
- Today's Presentation reflects my personal views

Growing Regional Economies

- To transform their economies, countries around the world are investing in:
 - New Universities
 - S&T Parks
 - New Research Facilities
 - Cutting Edge Technologies
- Innovation is 'spiky': It takes place in clustered ecosystems
 - Regions need to develop the support infrastructure and conditions to make them more likely to be where ideas can be transformed in to products, jobs, and growth

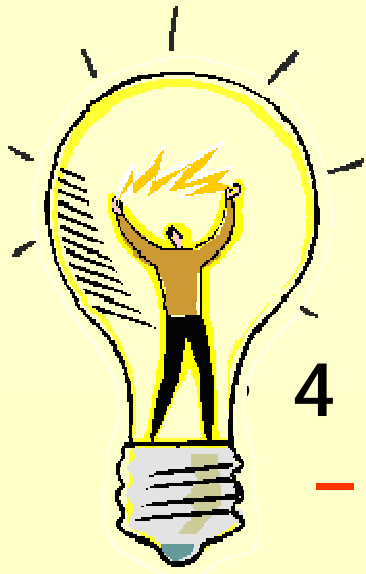
What is an “Innovation Ecosystem”?

- The term refers to the complex synergies involved in bringing innovation to market
 - Networks of collaboration across large and small businesses, universities, and research institutes and laboratories, as well as venture capital firms and financial markets
 - Highlights dynamic nature of innovation
- Focuses on the incentives and institutions needed for successful collaboration
 - Role for policy in improving market information, facilitating research cooperation, and incentivizing entrepreneurial behavior

Global Competition is Increasing in Scale and Effectiveness

- **China** brings scale advantages, national focus and resources
 - National Goal to become a Global Manufacturing & Leading Edge R&D Center
 - Intense Focus on Innovation & Institutional Change
 - Major Investments: over 100 S&T parks
- **India's** Policy Liberalization is unleashing growth
 - Emerging as a center for high-end R&D
- **Japan** is Restructuring its Innovation System
 - High level policy focus and major investments
- **The UK, France, Netherlands, and Germany** are renewing & funding up tech programs

The Pace of Competition is Accelerating



The Global Innovation Imperative

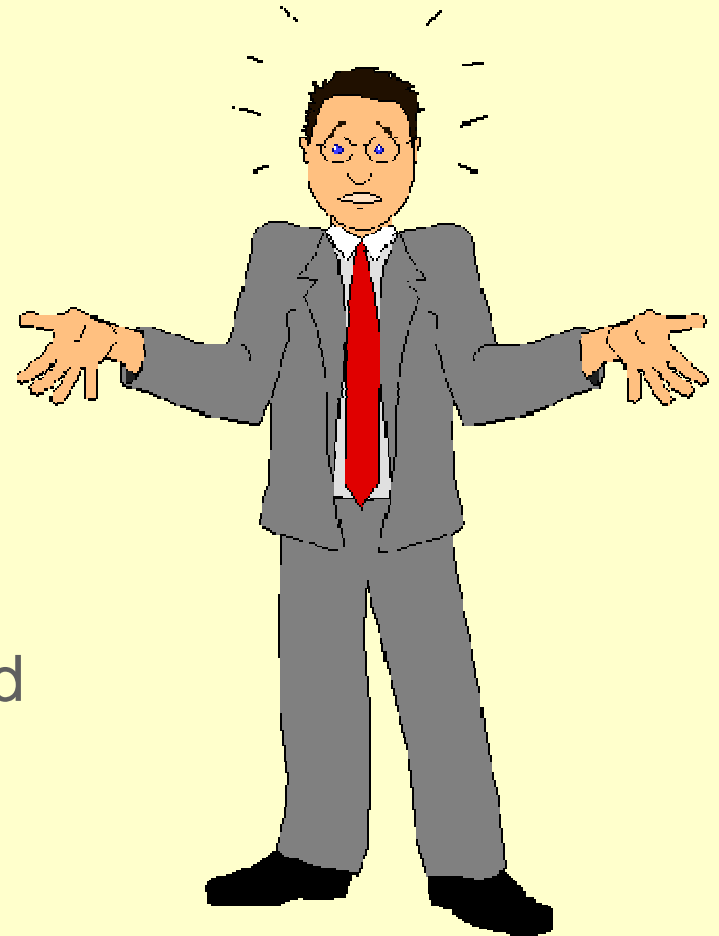
4 Key Points

- **Innovation** is Widely Recognized as Key to Growing and Maintaining a Country's Competitive Position in the Global Economy
- **Collaboration** is Essential for Innovation as Small Businesses and Universities Play a Growing Role in the Innovation Process
- **Institutional Change** is Necessary to Compete Successfully
- **New Incentives** are Required for Change

What is the United States Strategy?

What Strategy?

Current proposals reflect a renewed pragmatism about the need for innovation-based growth



U.S. Norms Create Positive Incentives for Entrepreneurs

- **Openness to innovation**
 - Trust in Science & Scientific Institutions Positive Social Norms
- **High Social Value on Commercial Success**
 - Forgiving Social Norms allow more than one try
- **Entrepreneur-friendly Policies**
 - Markets Open to Competition means easy entry
 - Gentle Bankruptcy Laws permit rapid recovery
 - Taxes give Prospect of Substantial Rewards
- **Strong Intellectual Property Regime:**
 - Encourages Research & Diffusion

The Result is Robust Small Businesses Innovation

- Small Businesses generated 60 to 80 percent of net new jobs annually over the last decade
- Employ 39 percent of high tech workers, such as scientists, engineers, and computer workers
- Produce 13 to 14 times more patents per employee than large patenting firms
 - Patents are of High Quality
 - Twice as likely as large firm patents to be among the one percent most cited
- **Small Companies are a Key source of Innovation by themselves and for Large Companies**

Sources: SBA Office of Advocacy (2005) data drawn from U.S. Bureau of the Census; Advocacy-funded research by Joel Popkin and Company (Research Summary #211); Federal Procurement Data System; Advocacy-funded research by CHI Research, nc. (Research Summary #225); Bureau of Labor Statistics, Current Population Survey; U.S. Department of Commerce, International Trade Administration

Innovation leads to New Firm Creation

- Small Innovative Firms are a Leading Source of Growth in Employment in the United States
 - Microsoft, Intel, AMD, FedEx, Qualcomm, Adobe have changed U.S. Economy, not to mention Google
- Equity-Financed Small Firms are One of the Most Effective Mechanisms for Capitalizing on New Ideas and Bringing Them to the Market
 - See Audretsch and Acs

Challenges Facing Innovation in the U.S.

Low Science Literacy
Visa limits on Skilled Immigrants
Stagnant R&D

Low Science Literacy is a Barrier to a Knowledge-Based Economy

- Scientific literacy is low among American adults.
- According to a national survey commissioned by the California Academy of Sciences and released on Feb 25, 2009:
 - Only 53% of adults know how long it takes for the Earth to revolve around the Sun.
 - Only 59% of adults know that the earliest humans and dinosaurs did not live at the same time.
 - Only 47% of adults can roughly approximate the percent of the Earth's surface that is covered with water.
 - Only 21% of adults answered all three questions correctly.

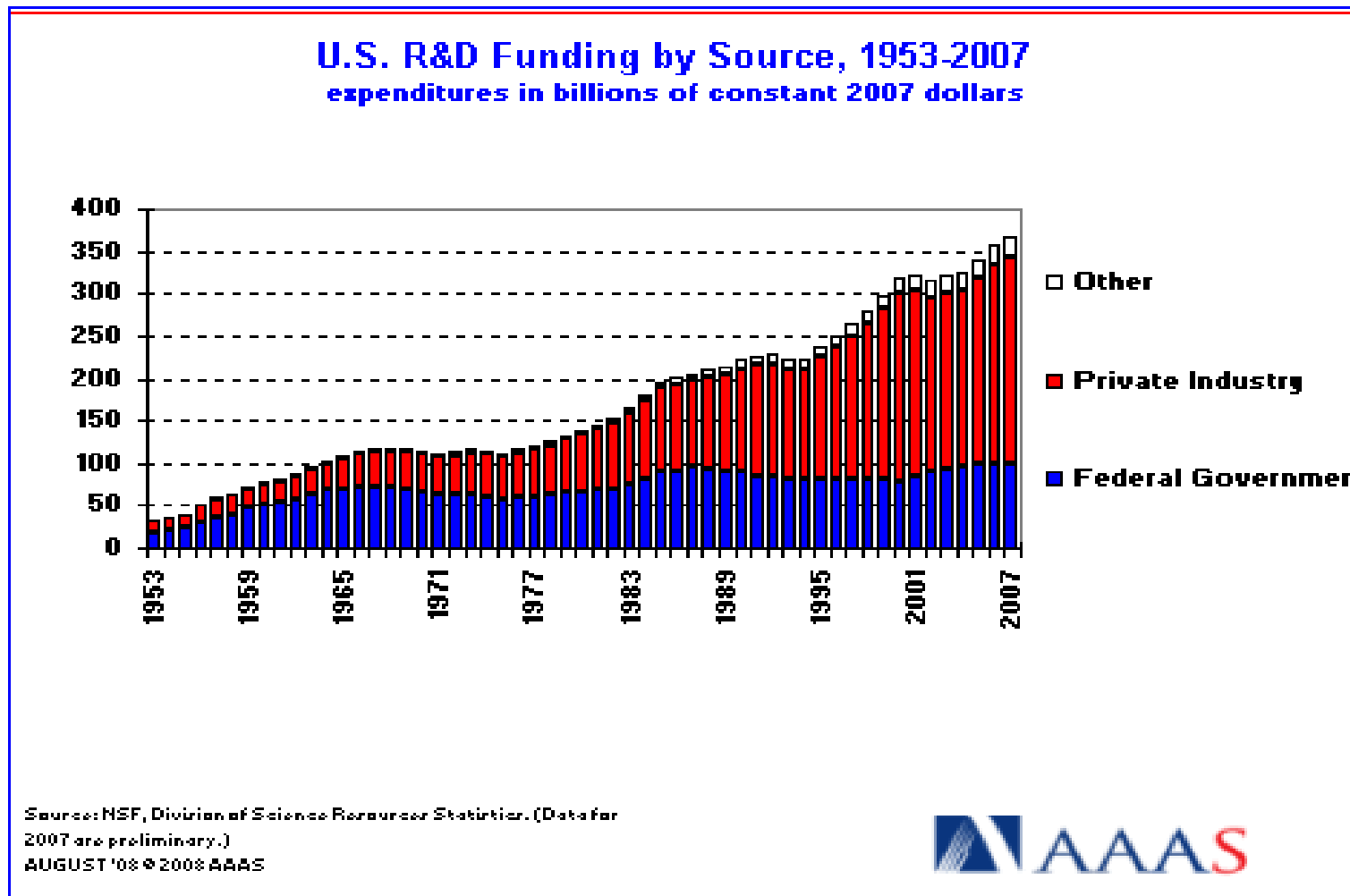
The Immigration Mythology

- **Myth: Immigrants displace American workers**
- **Reality: Skilled immigrants create jobs and economic opportunity in the United States**
 - Nationwide, over 25% of tech companies founded in the United States from 1995 to 2005, the chief executive or lead technologist was foreign-born. (52% in Silicon Valley)
 - In 2005, these companies generated \$52 billion in revenue and employed 450,000 workers.
 - Immigrants have founded 35 percent of start-ups in high tech industries
 - Source: Vivek Wadhwa: Duke University
 - Andy Grove (Hungary), Sergei Brin (Russia) and Vinod Khosla (India) are all immigrants

The Immigration Mythology

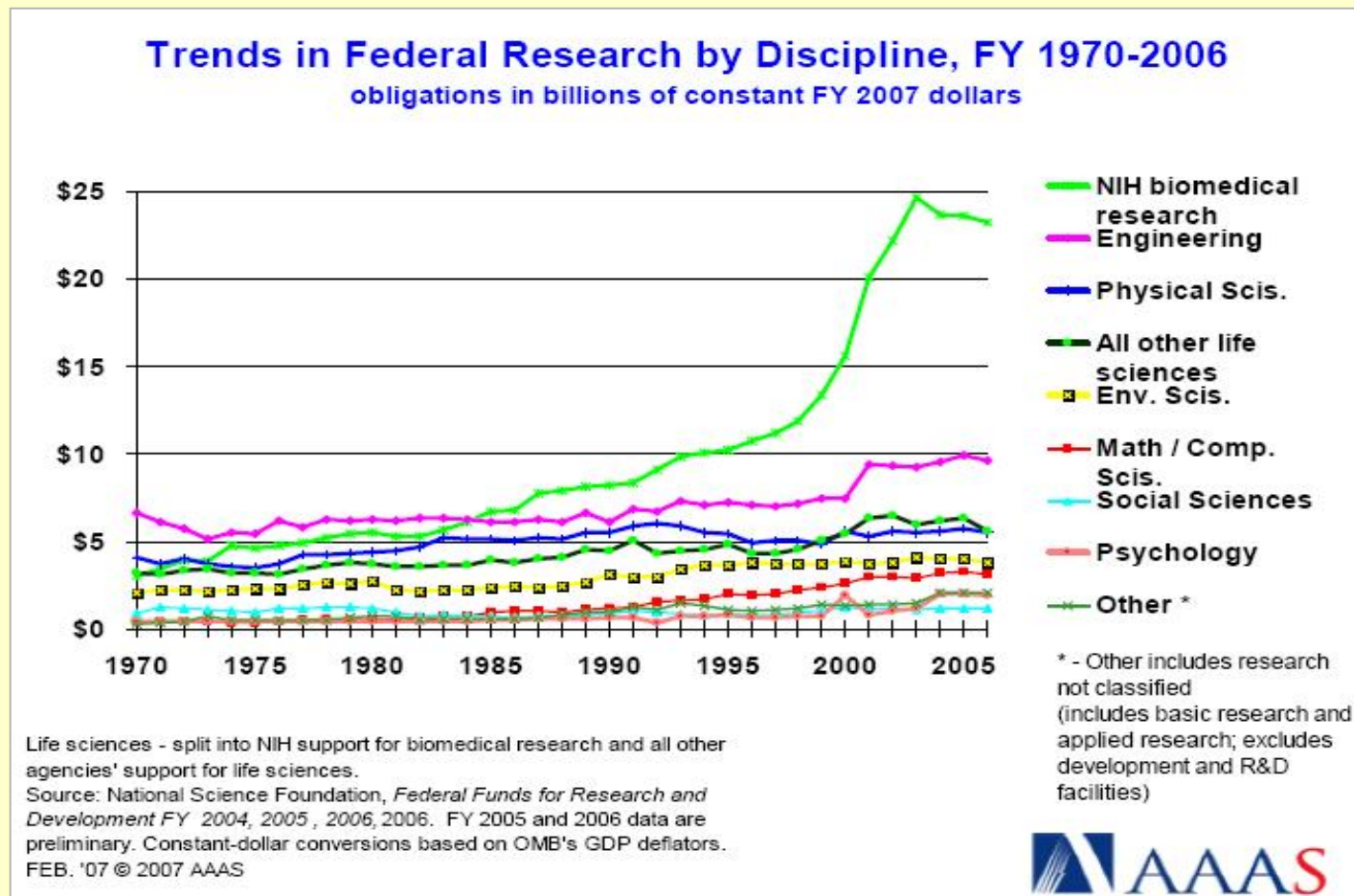
- Myth: Skilled Immigrants makes it easier for employers to move more jobs to low-cost countries like India.
- Reality: U.S. immigration policy is actively discouraging talented foreigners from contributing to the U.S. economy.
 - In fact, highly skilled foreign-born workers are leaving the U.S. in droves, helping to make other nations more competitive.

Government R&D Levels have been Flat



The Federal R&D Portfolio is Uneven

Funding for Math, Engineering and Science Remain Stagnant
Will the Bio-medical Bet Pay-off?



What does this mean?

**How do we address our
current and future
challenges?**

President Obama at the National Academies—April 27, 2009



President Obama on Today's Challenges

- “Today, of course, we face more complex challenges than we have ever faced before:
 - **a medical system** that holds the promise of unlocking new cures and treatments -- attached to a health care system that holds the potential for bankruptcy to families and businesses;
 - **a system of energy** that powers our economy, but simultaneously endangers our planet;
 - **threats to our security** that seek to exploit the very interconnectedness and openness so essential to our prosperity; and
 - **challenges in a global marketplace** which links the derivative trader on Wall Street to the homeowner on Main Street, the office worker in America to the factory worker in China -- a marketplace in which we all share in opportunity, but also in crisis.”

Address to the National Academy of Sciences, April 27, 2009

Obama Pledges to Raise R&D and Create new Incentives for Innovation

- “We will devote more than 3 percent of our GDP to research and development.”
- “We will not just meet, but we will exceed the level achieved at the height of the space race, through policies that
 - invest in basic and applied research,
 - create new incentives for private innovation,
 - promote breakthroughs in energy and medicine, and
 - improve education in math and science.”

Address to the National Academy of Sciences, April 27, 2009

New Commitments to Support Innovation

- ü Doubling of federal funding for basic research over 10 years at NSF, NIST, DOE (Office of Science)
- ü New Investments in S&T Infrastructure
- ü New Financing for S&T and Innovation
- ü Making the research and experimentation tax credit permanent

What does the Stimulus Bill Fund?

Renewable Energy R&D, Deployment

- **\$2.5 billion** for applied research, development, and deployment of Renewable Energy Technologies.
This includes:
 - \$800 million for Biomass Technologies
 - \$400 million for Geothermal Technologies
 - \$50 million to increase energy efficiency of information and communications technology
- **\$400 million** to establish the Advanced Research Projects Agency for Energy E-ARPA
- **\$6 billion** to support loan guarantees for renewable energy and transmission technologies
- **\$4.5 billion** to modernize the nation's electric grid
- Extension (and Monetization) of Renewable Energy Tax Credits

What does the Stimulus Bill Fund?

Energy Conservation

- **\$9 billion** for weatherization assistance for homes, retrofit public housing
- **\$4.5 billion** to convert federal building into high-performance green buildings
- **\$3.2 billion** to state and local governments to support energy efficiency and conservation strategies
- **\$3.1 billion** in additional grants for states that adopt strict building codes and energy efficiency guidelines
- **\$300 million** in consumer rebates for energy efficient appliances
- **\$200 million** in energy conservation projects at DOD

What does the Stimulus Bill Fund?

Green Transportation Technologies

- **\$2 billion** for advanced batteries for cars
 - Supports development of advanced Lithium-ion batteries and hybrid electrical systems
- **\$300 million** to develop alternative vehicle fuels
- **\$300 million** to acquire a green fleet for the federal government

What does the Stimulus Bill Fund?

Modernization and Expansion of Health Care

- **\$19 billion** as incentives to doctors and hospitals to upgrade to electronic medical records
- **\$10 billion** for research funding on drugs and medical devices
- **\$87 billion** in increased funding for low-income and disability programs

2009 Budget Raises R&D Portfolio

- The Federal R&D portfolio grows by \$6.8 billion to \$151.1 billion
- All major R&D agencies receive increases in R&D budgets
- Funding for NSF, the Department of Energy's Office of Science, and NIST increased for FY 2009
- Plan is to double their budgets over a decade

Our National Challenge:
How to Transform Growing
Investments in R&D into
Innovations for the Market?

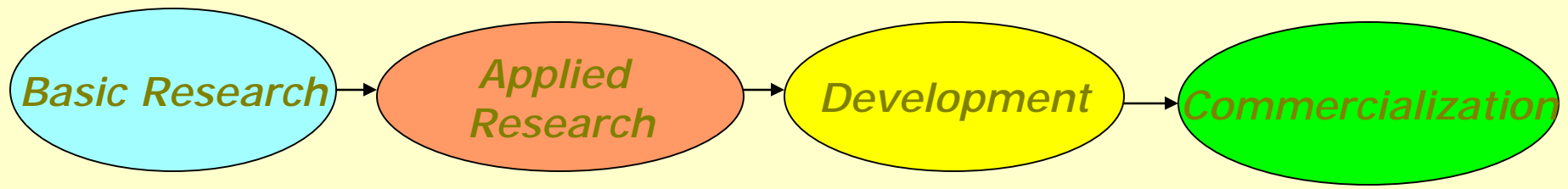
Role for Proven Public-Private
Partnerships

But Policy Myths Hinder our Ability to
Use Proven Policy Tools

Two Strong Policy Myths

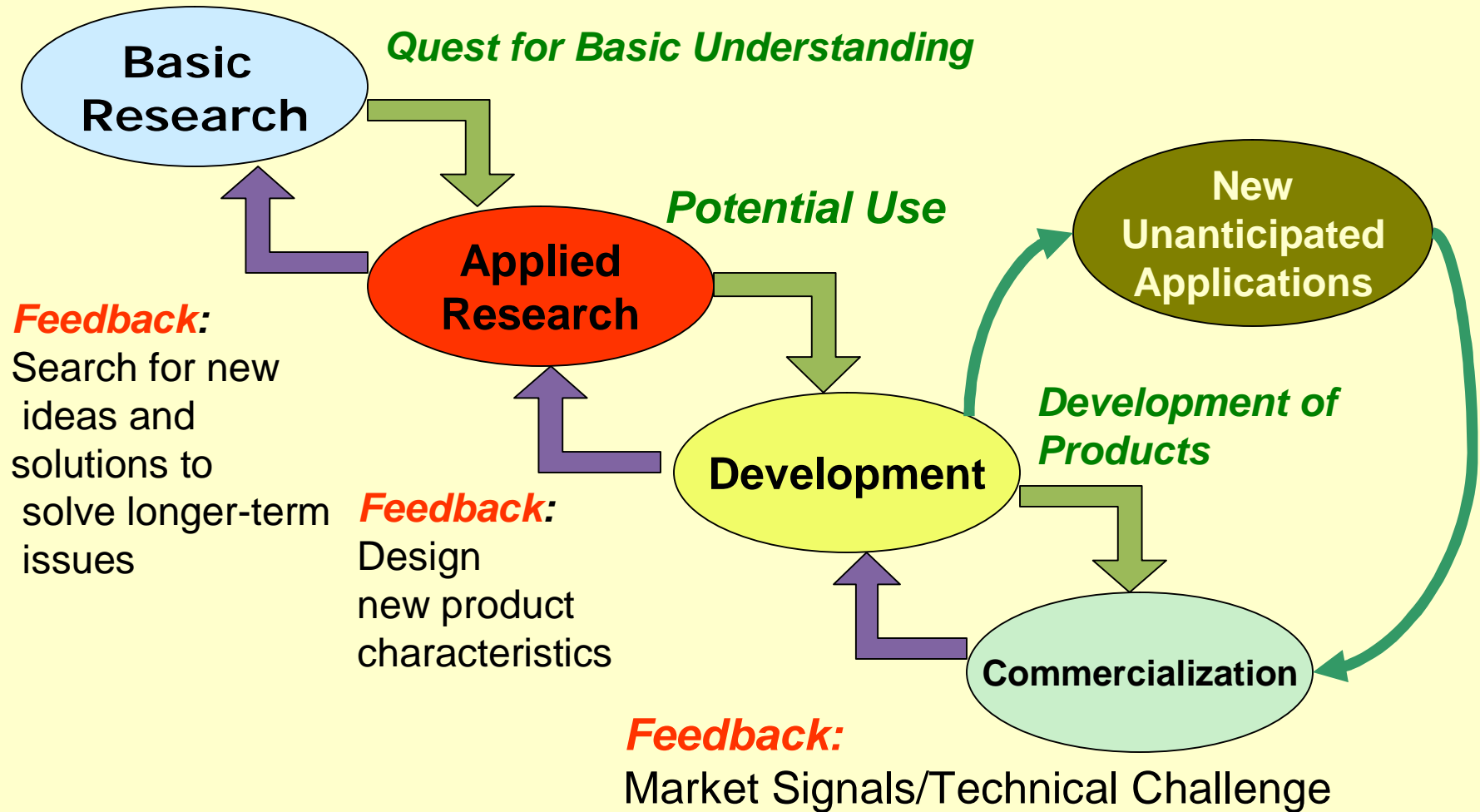
The Myth of Linear Innovation
The Myth of Perfect Markets

The Myth of the Linear Model of Innovation



- **Reality: Innovation is a Complex Process**
 - Major overlap between Basic and Applied Research, as well as between Development and Commercialization
 - Principal Investigators and/or Patents and Processes are Mobile, i.e., not firm-dependent
 - Many Unexpected Outcomes
 - Technological breakthroughs may precede, as well as stem from, basic research
- **Many of our policies and institutions remain based on this linear model**

Non-Linear Model of Innovation



The U.S. Myth of Perfect Markets

- Strong U.S. Myth: “If it is a good idea, the market will fund it.”
- Corollary: The government has no role in ‘picking winners and losers’
- **What is the Reality?**
 - Real world asymmetries mean markets often fail to reward ‘good ideas’
 - 2001 Nobel Prize in Economics awarded to Joseph Stiglitz, Michael Spence, and George Akerlof for their pioneering analysis of information asymmetries
 - The U.S. actually has a long history of great success in picking winners

Picking Winners

- **1798** - Grant to Eli Whitney to produce muskets with interchangeable parts, founds first machine tool industry
- **1842** - Samuel Morse receives award to demonstrate feasibility of telegraph
- **1903** – Wright Brothers fly, fulfilling the terms of an Army contract!
- **1915** – National Advisory Committee for Aeronautics instrumental in rapid advance in commercial and military aircraft technology

Picking More Winners

- **1919** – Radio manufacturing (RCA) founded on initiative (equity and Board Membership) of U.S. Navy with commercial and military rationale.
- **1940s, '50s, '60s** – Jet Aircraft, Semiconductors, Computers, Satellites, Nuclear Energy
 - Government-supported industries are “the Foundations of the Modern Economy,” Cohen & Noll
- **1969-1990s** - Government investment in forerunners of the Internet (Arpanet) and establishment of the Global Positioning System
- **Today:** Current investments in genomic and biomedical research, advanced computing and new materials, e.g., nanotechnology initiatives

Government Role in Innovation

- Listening to some Americans critical of the government's role brings to mind the Jewish patriot criticism of the Romans in the Monty Python film "Life of Brian". "

– The Economist, May 1, 2004



- But what, apart from the roads, the sewers, the medicine, the Forum, the theater, education, public order, irrigation, the fresh-water system and public baths...
what have the Romans ever done for us?
(and the wine, don't forget the wine...)

Another Common Myth

- Myth: “U.S. VC Markets are broad & deep, thus there is no role for government awards”
- Reality: Venture Capitalists have
 - Limited information on new firms
 - Prone to herding tendencies
 - Focus on later stages of technology development
 - Most VC investors seek early exit

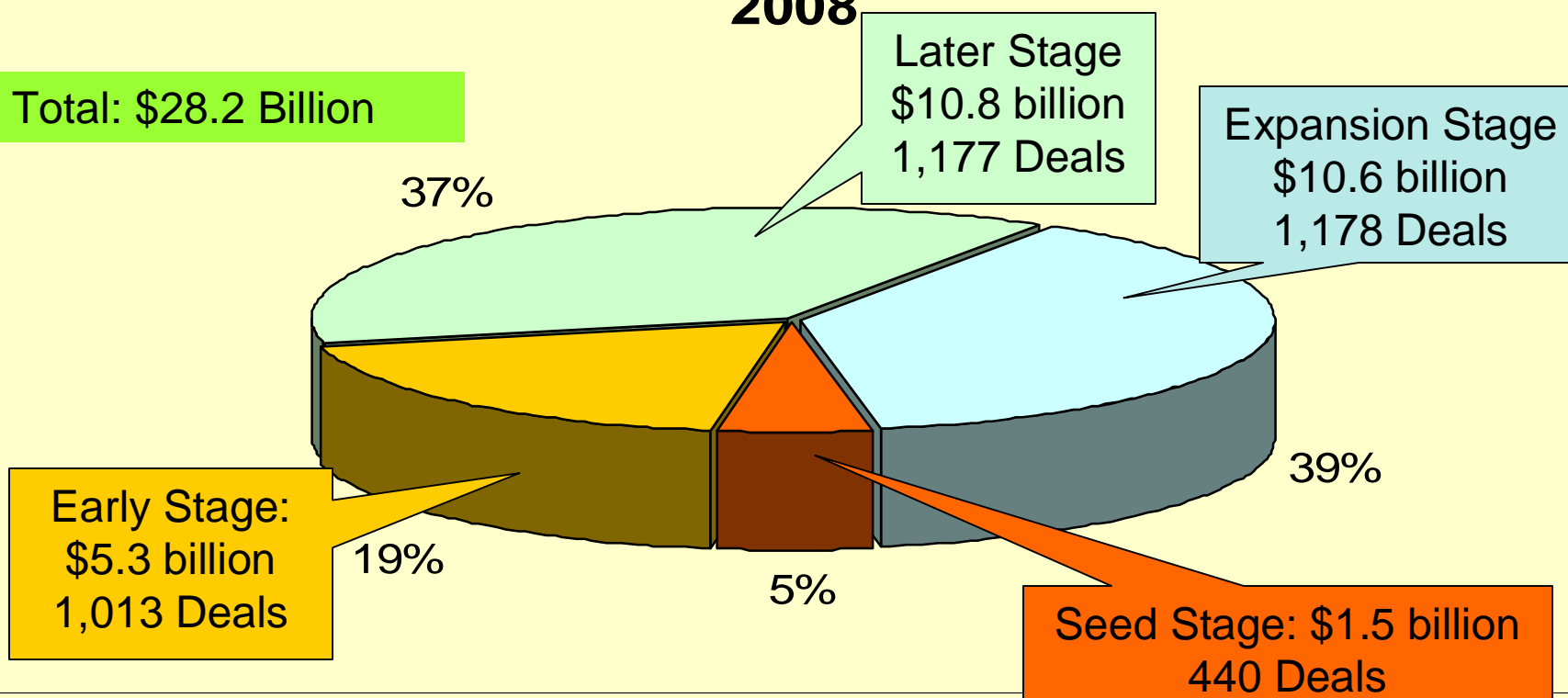
Limits of U.S. Venture Capital Market: Not Focused on Early-Stage Firms

- Information on potential product is limited: Risk is too high
 - Proof of concept/prototype often absent or not yet achieved
 - Even Angel investors need more information
- Fund Operations: Small Investments have High Overhead Costs
 - Most Early Stage firms need investments in the \$100K to \$700K range
 - Average VC investment is \$8.9 million in 2006 (Source: NSF S&E Indicators, 2008)
 - Most VC firms do not want to manage numerous small investments...and they do not!

Large U.S. Venture Capital Market is Not Focused on Seed/Early-Stage Firms: Aggregate Amounts are Falling

U.S. Venture Capital by Stage of Investment 2008

Total: \$28.2 Billion



Source: PriceWaterhouseCoopers/Thompson Venture Economics/ NVCA 2009

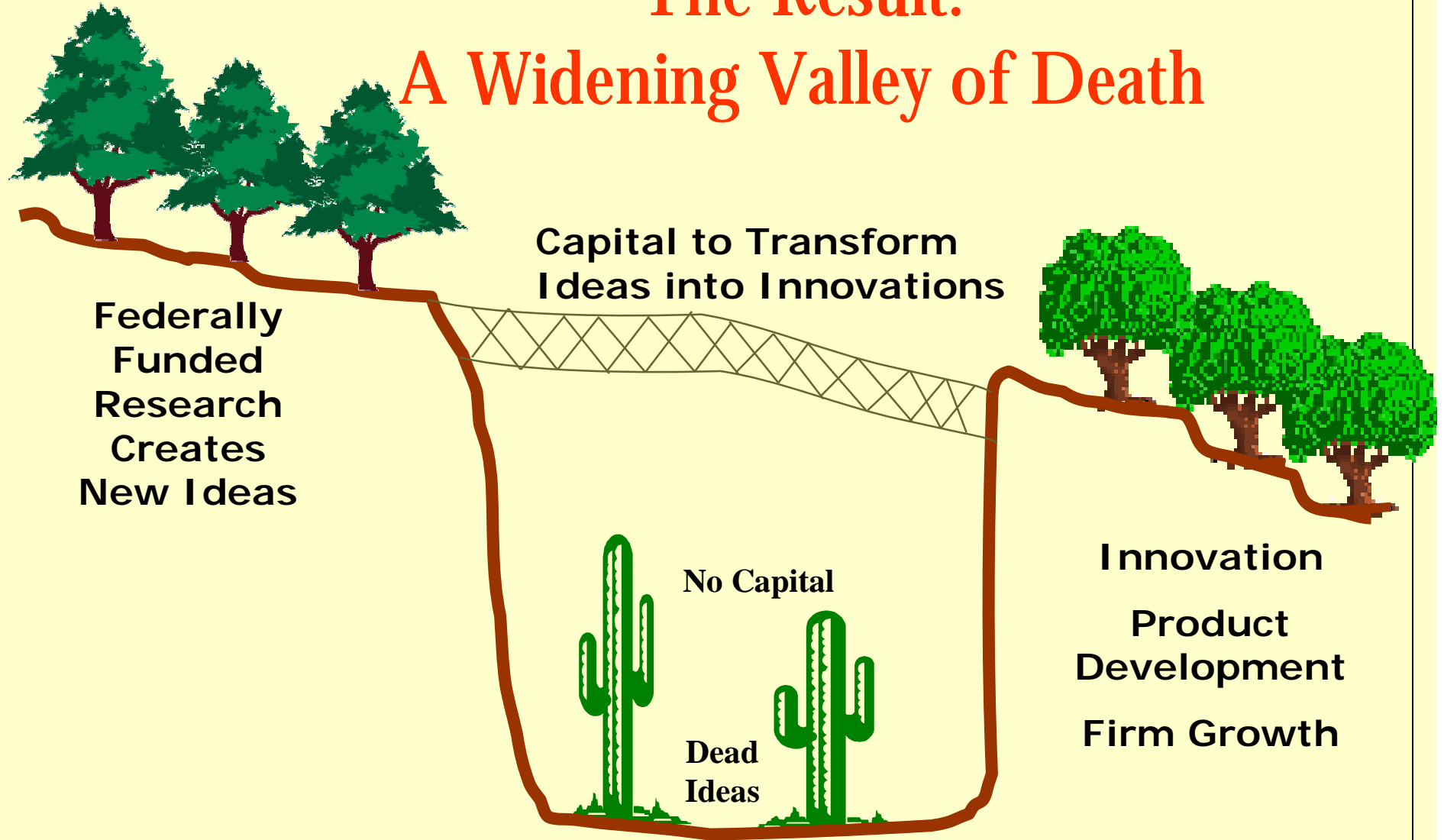
Venture Capital Markets are in a 'Pause' Mode

- Markets are cyclical, and so is venture capital:
 - Majority of venture firms are “waiting until market conditions improve.” [NVCA 2009 1st Quarter Report]
- **Few Exits:** For the market to function, liquidity events, (i.e., acquisition or initial public offering) must be possible
 - Last year, Silicon Valley saw only one IPO
- **Few Entries:** Venture Capitalists are retrenching
 - VC funds are conserving Capital to preserve the existing portfolio investments
 - Few new investments are being undertaken
- **Markets are drying up: Promising New Companies with Valuable New Ideas are at Risk**

The Venture Capital industry is still in Retreat

- **Drop in number of investments made**
 - 50% drop in first quarter investing from the comparable quarter a year ago
 - Down even 34½ % from a none too stirring 4th quarter of 2008
 - Source: Lipper Report, April 19, 2009
- **Drop in funds put to work**
 - \$4B was put to risk in 477 investment rounds, the lowest quarter in more than a decade
 - Less than Half of 1% for Seed Stage
 - Source: Dow Jones VentureSource

The Result: A Widening Valley of Death



Crossing the Valley of Death

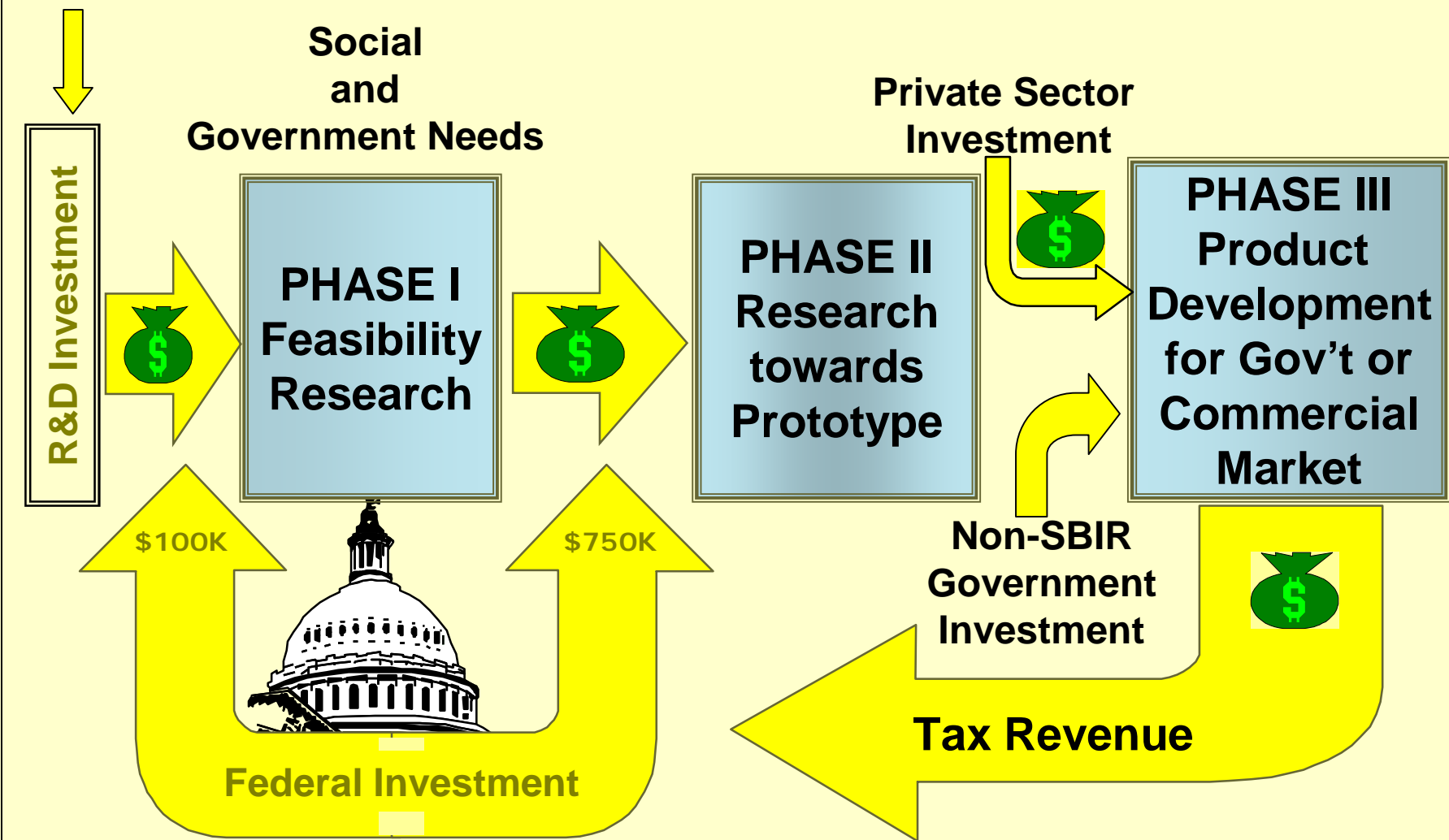
The Small Business Innovation Research (SBIR) Program

The SBIR Program—Key Features

- **Long-lived:** In place for 25 years
 - Created by the Small Business Innovation Act of 1982 & renewed in 1992 & 2001
- **Decentralized:** Each Agency uses its funds to support research by small companies to meet its mission needs
- **No New Money:** 2.5% of Agency R&D budgets set-aside for small business awards
 - This provides budget stability and growth
- **Large Scale:** Largest U.S. Innovation Partnership Program
 - Currently a \$2.3 billion per year
- **Focus:** Funds Proof of Concept and Prototype
- **Helps firms across the Valley of Death and attract private capital or public contracts**

\$151
billion

The SBIR “Open Innovation” Model



“The SBIR program is sound in concept and effective in practice.”*

**Key Finding of the Recently
Concluded National Academies
Assessment of SBIR**

*See National Research Council, An Assessment of the SBIR Program, 2008

Academies Research Reveals SBIR Impact on Firm Formation and Growth

- **Company Creation:** 20% of responding companies said they were founded as a result of a prospective SBIR award (25% at Defense)
- **Research Initiation:** SBIR awards played a key role in the decision to pursue a research project (70% claimed as cause)
- **Company Growth:** Significant part of firm growth resulted from award
- **Partnering:** SBIR funding is often used to bring in Academic Consultants & to partner with other firms

SBIR: Positive Employment Effects

- **Direct Impact of Awards on Employment:**
 - The NRC Phase II Survey respondents estimated that, their firm was able to hire an average of 2.4 employees, and to retain 2.1 more as a direct result of the award
- **Employment Gains from Firm Growth:**
 - Addition of 30 full-time equivalent employees
- **Overall Job Gains:**
 - NRC survey respondents reported direct and indirect gains of 57,808 full time equivalent employees
- **Based on NRC SBIR Phase II Survey**
 - Data from the date of the firm's SBIR award to the time of the NRC survey
 - Based on 1,916 survey responses

SBIR Generates New Knowledge

- **SBIR Generates Knowledge**
 - **Patents:** About 30 percent of NRC survey respondents received patents related to their SBIR research.
 - About two-thirds of projects generated at least one patent application
 - **Publications:** Slightly more than half of NRC survey respondents had published at least one related peer-reviewed scientific paper
- **SBIR Broadens Scope & Speed of Research**
 - Helps firms initiate new high-risk research
 - Helps broaden the scope of existing research

What does this mean?

SBIR provides a concrete return on investment
—New Firms, New Jobs, New Knowledge—
on the Nation's \$151 billion annual investment
in R&D

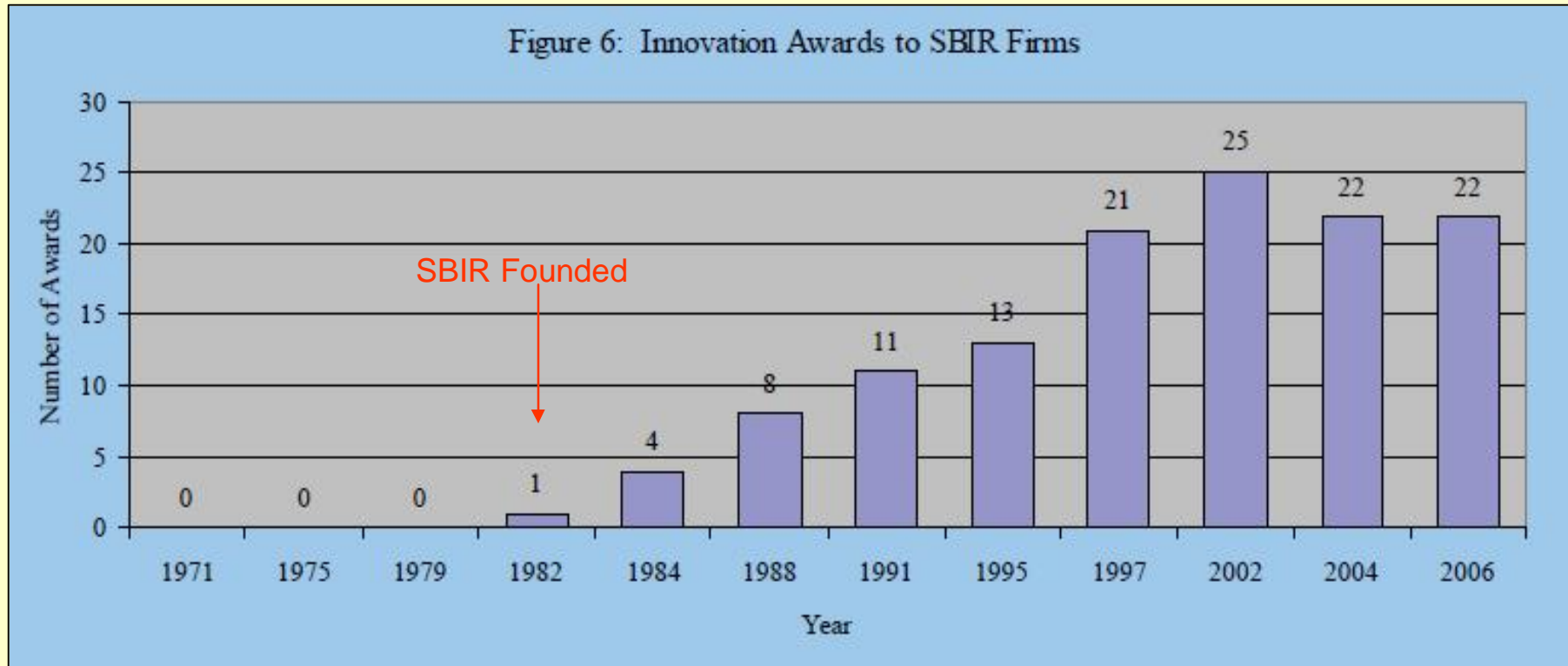
Recent Parallel Research Highlights the Impact of SBIR Awards

Recent Research from the University of
California finds that SBIR contributes to
top U.S. innovations

-Findings Complement NRC Research-

“The SBIR program has become a key force in the innovation economy of the United States”

Figure 6: Innovation Awards to SBIR Firms



- SBIR now accounts for nearly a quarter of all ‘U.S. R&D 100’ winners, an annual list of top 100 innovations
 - Source: Block and Keller, “Where do innovations come from?” ITIF, July, 2008

What can Loudon County do to Enhance Innovation-led Growth?

Upgrade Governance Mechanisms
Leverage Federal Funding
Create an S&T Park



Loundon County's Advantages

- **Location, Location, Location**
 - Near Washington DC
 - Home to Dulles International Airport
 - Transportation and Air Shipment hub
- **Significant Presence of High Tech Industry**
 - High technology industry cluster around Dulles
 - Home to Verizon, Telos, and Orbital Sciences
- **Universities and Research Centers**
 - GWU and GMU Satellite Campuses
 - Howard Hughes Medical Institute JFR Campus
- **Highest Median Household income in the United States**
- **How can Loundon Leverage these Advantages?**

Upgrade Governance Mechanisms

- Expand Loudon's Economic Development Commission (EDC)
 - EDC is a public/private partnership, responsible for promoting the county's economic development
 - EDC already enjoys strong industry representation
- EDC can also serve as an intermediating institution to develop, coordinate, & evaluate good innovation policy by
 - Bringing together University leaders, Industry and SME representatives
 - Convening national and international experts to draw on best practice in innovation policy

Leverage SBIR for Local Growth

- Matching Grants can help attract federal grants to Loudon County
- A Proven Approach—Next Door
 - North Carolina has instituted one of the country's most substantial support programs for SBIR award winners
 - North Carolina awards up to \$100,000 in matching funds to each company that won a SBIR grant from the federal government.
 - This approach reinforces support for high-potential small firms
 - Source: Robert McMahan, North Carolina Board of Science and Technology

Stimulate Economic Development with an S&T Park

- Well-conceived and regularly assessed S&T Parks can
 - Facilitate Firm Creation
 - Generate Critical Mass for a Regional Economy
 - Encourage New and Existing Firms and the New Jobs and Growth they bring
 - Have concrete impacts on jobs and growth that build support in the Community and the State
- S&T Parks are a Valuable Part of the Innovation Ecosystem that needs to be reinforced with federal incentives

S&T Parks are a Proven Catalyst for Regional Development

- Well-conceived and regularly assessed S&T Parks can
 - Advance university missions
 - Help create companies
 - Build partnerships among researchers, small companies, and large companies
 - Increase public support and help justify increases for university funding



Innovating our way to the Future

What is the Recipe for Success?

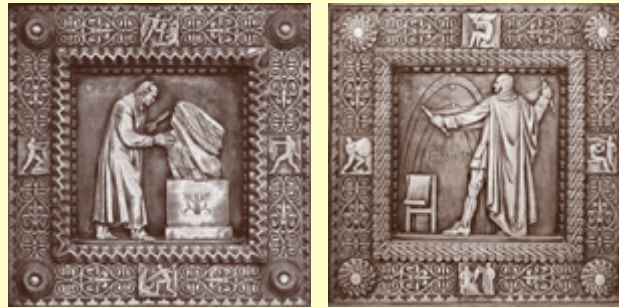
There is a Proven Recipe for Success

- Ensure Positive Framework Conditions to support Growth
- Introduce Focused, Proven Programs
 - Well funded by a patient government
- Create 21st Century Universities
- Launch new Institutions—e.g., S&T Parks
- Support Dynamic Small Business Entrepreneurs, supported by all the above

What does this mean for Loudon County?

- Recognize that research funding is not for Academics; it is the Economy's lifeblood
- Leverage Federal Programs
 - Understand that translational mechanisms like Innovation Awards and S&T Parks are needed to capture the benefits of research
- Develop a positive business and educational climate
 - Intellectual capital matters, even if it has a Green Card
 - Create the Translational Mechanisms
- Work together for a Common Future

Thank You



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